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| **AT estimation: defining the structure of the V̇CO2-V̇O2 relationship** |
| *Simon Green1**,2, Matt Goldsmith1, Belinda Cochrane3,4* |
| *1School of Health Sciences, Western Sydney University, NSW, Australia.*  *2Department of Cardiology, Campbelltown Hospital, NSW, Australia.*  *3Department of Respiratory, Campbelltown Hospital, NSW, Australia.*  *4School of Medicine, Western Sydney University, NSW, Australia* |
| **Introduction/Aim:** Visualestimation of the anaerobic threshold (AT) assumes that the relationship between V̇CO2 (y) and V̇O2 (*x*) during graded exercise is biphasic although its structure has not been established. The aim was to investigate this structure through statistical comparison (F-test) of goodness-of-fits of common linear functions.  **Method:** 10 healthy participants completed a maximum ramp protocol (10 W.min-1) on a cycle ergometer with ventilation and respiratory gas fractions measured breath-by-breath. V̇CO2-V̇O2 data were fitted to 2-, 3- and 4-phase functions and paired comparisons of goodness-of-fits were used to identify the best-fit function and approximate the structure of the dynamic response. AT estimates from the three functions were also compared.  **Results:** Exercise evoked more than a 10-fold change in V̇O2 and V̇CO2 from rest (V̇O2 = 0.28 ± 0.05 L.min-1, V̇CO2 = 0.25 ± 0.04 L.min-1) to peak (V̇O2 = 2.96 ± 0.56 L.min-1, V̇CO2 = 3.43 ± 0.62 L.min-1). The four-phase function provided a significantly better fit (F > critical F) to V̇CO2-V̇O2 responses than the two-phase (N = 8) and three-phase (N = 6) functions. AT estimates from the three functions differed significantly (F2,20 = 15.8, P < 0.001) and was lowest for the three-phase function (1.06 ± 0.33 L.min-1) compared with two-phase (1.67 ± 0.60 L.min-1) and four-phase (1.77 ± 0.50 L.min-1) functions. Case-by-case analysis showed that absolute differences between AT estimates associated with two- and four-phase functions exceeded half the confidence interval of the estimate from the four-phase function in 5/10 participants.  **Conclusion:** The V̇CO2-V̇O2 relationship consists of three or four phases and AT estimates associated with fitting a four-phase function can differ significantly when compared with use of a biphasic function. The superior fitting and larger AT estimates from the four- versus three-phase function suggests the additional phase needs to be considered when estimating AT.  **Key Words:** CPET, healthy, anaerobic threshold, curve-fitting  **Grant Support: NA** |